MKS-30 SERVICE NOTES *First Edition*

SPECIFICATIONS

MEMORY CAPACITY.....Internal: 64 patches
(16Kbyte RAM)
External: 64 patches
(M-16C memory cartridge)

EDITABLE PARAMETERS...32

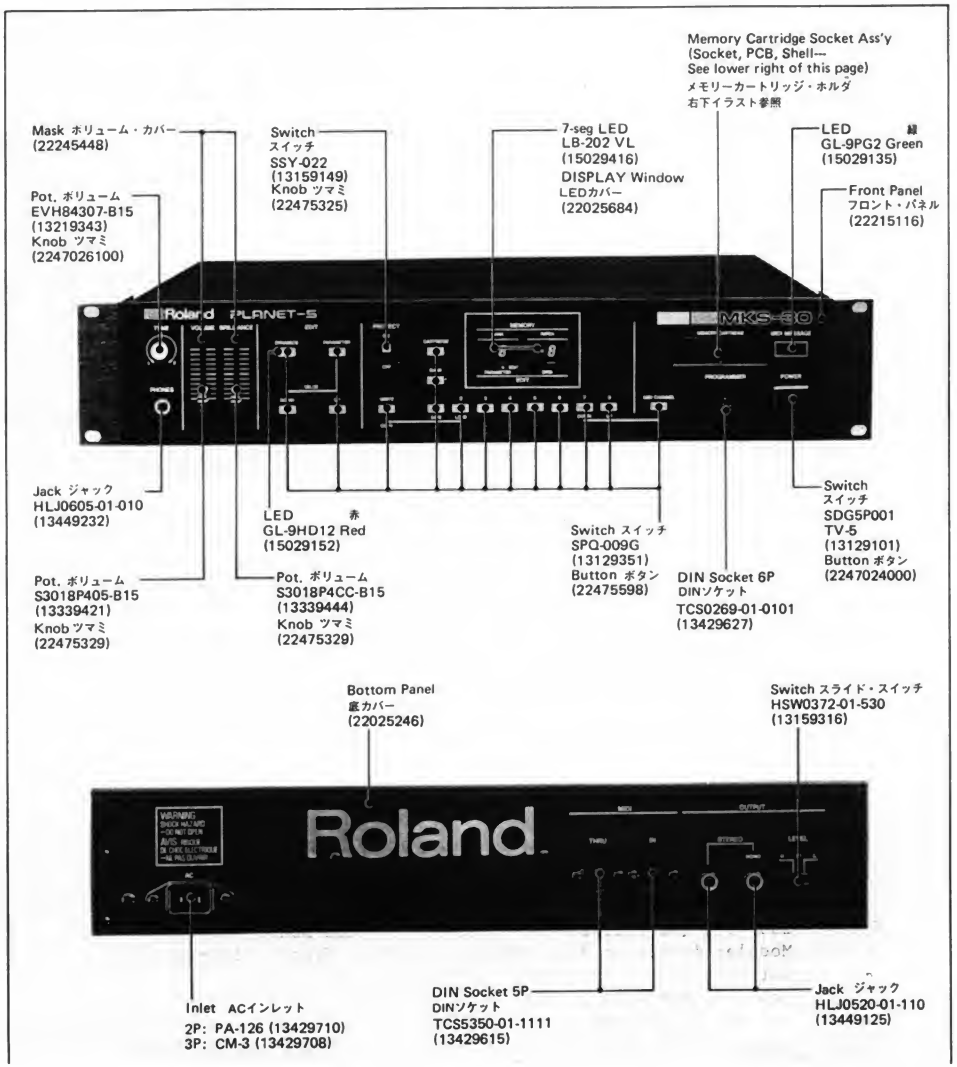
OUTPUT.....Impedance: 5KΩ
Headphones: 8Ω

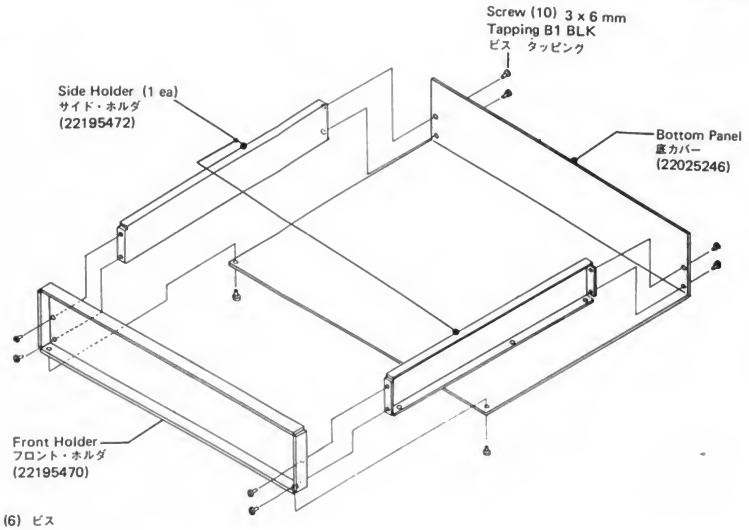
POWER CONSUMPTION.....35W

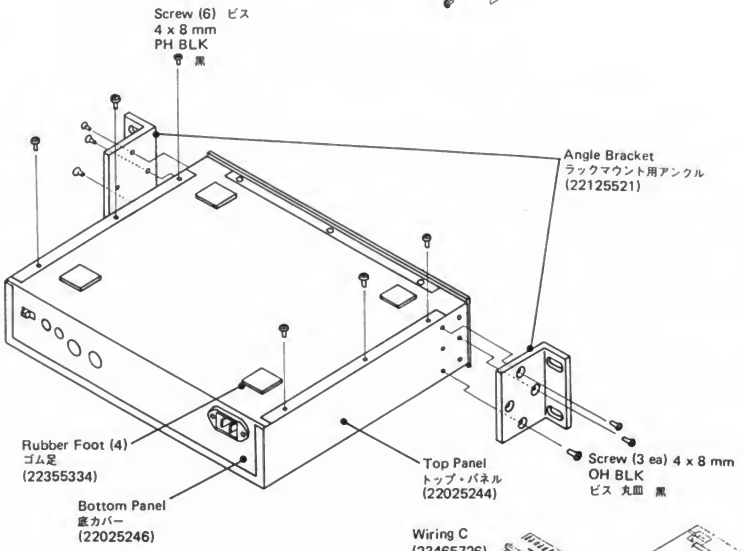
DIMENSIONS.....480(W) x 410(D) x 88(H) mm
19"(W) x 16-1/8"(D) x 3-7/16"(H)

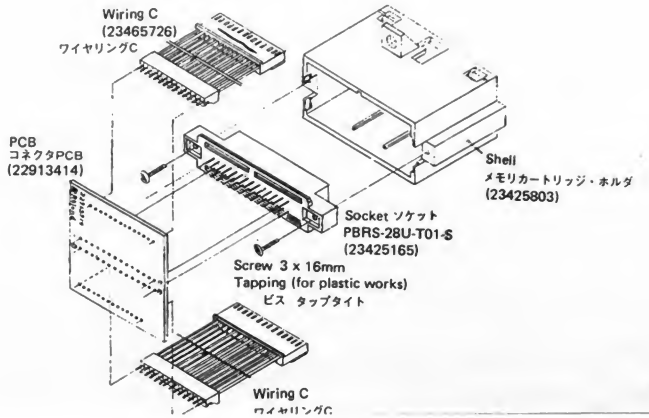
WEIGHT.....6.2 kg / 13 lb. 11 oz.

ACCESSORIES.....Connection Cord (LP-25)
5 pin DIN Cord
6 pin DIN Cord
Detachable Cord Set
Memory Cartridge (M-16C)









PARTS LIST

PANEL, CASING パネル, ケース

22025244	Top Panel	トップカバー	
22215116	Front Panel	フロント・パネル	
22025246	Bottom Panel	底カバー	
22195470	Holder	ホルダー	上面 front
22195472	Holder	ホルダー	側面 side
22125521	Angle	ラックマウント用アングル	rack mounting
22025684	Display Window	LEDカバー	
22355334	Rubber Foot	ゴム足	

KNOB, BUTTON ツマミ, ボタン

22475598	Button ボタン	Push プッシュ	ライト・タッチ light touch	
2247026100	Knob ツマミ	Rotary ロータリ		TUNE
22475329	Knob ツマミ	Slider スライド		
2247024000	Button ボタン	Push プッシュ		POWER
22475325	Knob ツマミ			PROTECT

SWITCH スイッチ

13159316	HSW0372-01-530	Slide スライド		LEVEL
13159419	SSY-022	Slide スライド		PROTECT
13129351	SPQ-009G		ライト・タッチ light touch	
13129124	SDGA-3P			POWER

JACK, SOCKET ジャック, ソケット

13449232	HLJ0605-01-010			PHONES
13449125	HLJ0520-01-110			OUTPUT
13429627	TCS0269-01-0101	DIN 6P		PROGRAMMER
13429615	TCS5350-01-1111	DIN 5P		MIDI
13429710	AC Inlet PA-126	ACインレット		100/117/220V
13429708	AC Inlet CM-3	ACインレット		240V
7922412000	Memory Cartridge Socket Ass'y	メモリーカートリッジ・ホルダ		
	Including the following:	(下記を含む)		
23425165	Socket PBRS-28U-T01-S	ソケット・ホルダ		
7933908000	PCB (pcb 22913414)	コネクタPCB		
23425803	Shell (case)			

POWER TRANSFORMER 電源トランス

22455355N0		100V
22455356C0	or 22455417C0	117V
22455357D0	or 22455418D0	220/240V

COIL コイル

12449229	KFOB-160MH15	ライン・フィルタ Line Filter
12449221	40M-067-018	DCO Master OSC

CERAMIC RESONATOR 発振子

12389719	KMFC1007T31	12MHz
12389800	KMFC1005T1	6MHz

PCB ASS'Y 基板完成品

79339060	Main Board	メイン基板	(pcb 2291391601)	
79339070	Switch Board	スイッチ基板	(pcb 22913939)	
79339042	Power Supply/Chorus Board	電源/コーラス基板	(pcb 22913940)	100/117V
79339044	Power Supply/Chorus Board	電源/コーラス基板	(pcb 22913940)	220/240V

POTENTIOMETER ボリューム

13219343	EVH84307-B15			100KB	TUNE
13339421	S3018P405-B15			100KB	VOLUME
13339444	S3018P4CC-B15	Center Detent	センタークリック	100KB	BRILLIANCE
13299177	H0615C119-10KB	Trimmer	半固定		
13299189	H0615C119-4.7KB	Trimmer	半固定		
13299190	H0615C119-47KB	Trimmer	半固定		

IC

15179319	P8051-319	CPU
15179653	TMM2764	8K byte PROM
15179317	TC5517APL	2K byte CMOS RAM
15179110B0	M5L8253	programmable counter
15179192	M5L8041A	universal peripheral interface
15169304H0	HD74LS04	hex inverter
15169307H0	HD74LS27	3 input NOR gate
15169339H0	HD74LS32	quad 2 input or gate
15169318H0	HD74LS138	3 to 8 demultiplexer
15169322H0	HD74LS174	hex D flip-flop
15169321H0	HD74LS161	4 bit binary counter
15169327H0	HD74LS367	hex bus driver
15159503	TC40H000	quad 2 input NAND gate
15159524	TC40H245	8 bidirect bus buffer non invert 3 stage
15159511	TC40H174	hex D type flip-flop
15159508	TC40H373	octal D type latch
15159104S0	LM14011BP	quad 2 input NAND gate
15159113H0	HD14051BP	8ch analog multi/demultiplexer
15159129H0	HD14053BP	2ch analog multiplexer
15159134H0	HD14028BP	binary to octal decoder
15159128H0	HD14050BP	hex buffer
151891290A	TL072CP	OP amp (selected, Main Board)
15189129	TL072CP	OP amp
15189105	μPC4558	OP amp
15229802	BA662A	VCA
15199123	M5231L	VREF regulator
15229817	A10H800170	VCF, VCA
15159117	M5230L	tracking regulator
1589136	M5218L	OP amp
15219213	MN3009	BBD
15169504	MN3101	BBD driver
15199106	μPC7805	5V 3 terminal regulator
15149115	M54523	7 unit transistor array
15159702	M54563	8 unit transistor array

TRANSISTOR トランジスタ

15119106D0	2SA933-Q	
15129107	2SC945-Q	
151291080A	2SC945-Q (selected for NOISE)	
151291300G	2SC1583G	
15119814	2SB834-Y	
15129107	2SC1740S	
15129201	2SD880-Y	
15139103	2SK30A-GR	FET
15129107	2SC945-Q (Gm selected for TR3, TR4 of Main Board VCF/VCA Module; dotted in Red, Orange, Yellow or Green) 12 transistors (2 for each voice) on a given Main Board should be of the same color dot for reproducing uniform timbre. メイン基板TR3、TR4用選別品(色識別) 注(各モジュール間における音色差をなくすため、同一ユニット内では同色のものを使用する必要がある)	

15119133	DTA114F	抵抗内蔵		digital
15129150	DTC114F	抵抗内蔵		digital

DIODE ダイオード

15019103	1S2473		
15019612	05Z-5.1		ツェナー Zener
15019201	W-02		
15029152	GL-9HD12	LED	赤 Red
15029189	GL-9PG2	LED	緑 Green
15029416	LB-202VL	7 seg LED	

PHOTO COUPLER フォト・カプラ

15229703	P-873	Main Board
15229712	PC-900	MIDI

RESISTOR 抵抗

13819149	10Ω Solid	1/2W ソリッド		
13769161	3.3K		酸化金属被膜	Metal oxide film
13769173	10K		酸化金属被膜	Metal oxide film
13769182	24K		酸化金属被膜	Metal oxide film
13769565	4.7K		酸化金属被膜	Metal oxide film
13769569	6.8K		酸化金属被膜	Metal oxide film
1319310	RM-8 103J	10KΩ x 8	抵抗アレイ	Resistor array
13939321	RM-13 103J	10KΩ x 13	抵抗アレイ	Resistor array
13919146	RKM14L503F	R-2R	抵抗アレイ	Resistor array
15229909	ERS-B33G561	560Ω	ポジスタ	Posistor

CAPACITOR コンデンサ

13659214M0	ECET25R682SW	6800μF	25V	電解	Electro.
13659226M0	ECET35R472SW	4700μF	35V	電解	Electro.
13639932S0	25MV 10PN			バイ・ポーラ	Bipolar
13639922M0	ECE1CN 100S	10μF	16V	バイ・ポーラ	Bipolar
13639941M0	ECE1ENR47S	0.47μF	50V	バイ・ポーラ	Bipolar
13529104	DE7150F472HVA1 Line bypass	0.0047μF	250V	セラミック	Ceramic
13569168	CQ09S1H 560R0J05	560PF		スチロール	Polystyrene

FUSE, FUSE HOLDER ヒューズ, ヒューズ・ホルダ

12559336	GGS 2A		ヒューズ	100/117V
12559508	CEE T250mA		ヒューズ	220/240V
22199519	TF-758	Fuse Holder	ヒューズ・ホルダ	

CONNECTOR HOUSING コネクタ・ハウジング

13439121	5045-05A
13439122	5045-06A
13439123	5045-07A
13439124	5045-08A
13439126	5045-10A
13439155	5045-12A
13439157	5045-13A
13439164	5045-14A
13439169	3024-05CH

WIRING ASS'Y ワイアリング・アッセンブリ

23463767	A	
23463768	B	
23465726	C	メモリーカートリッジ Memory Cartridge
23463770	D	

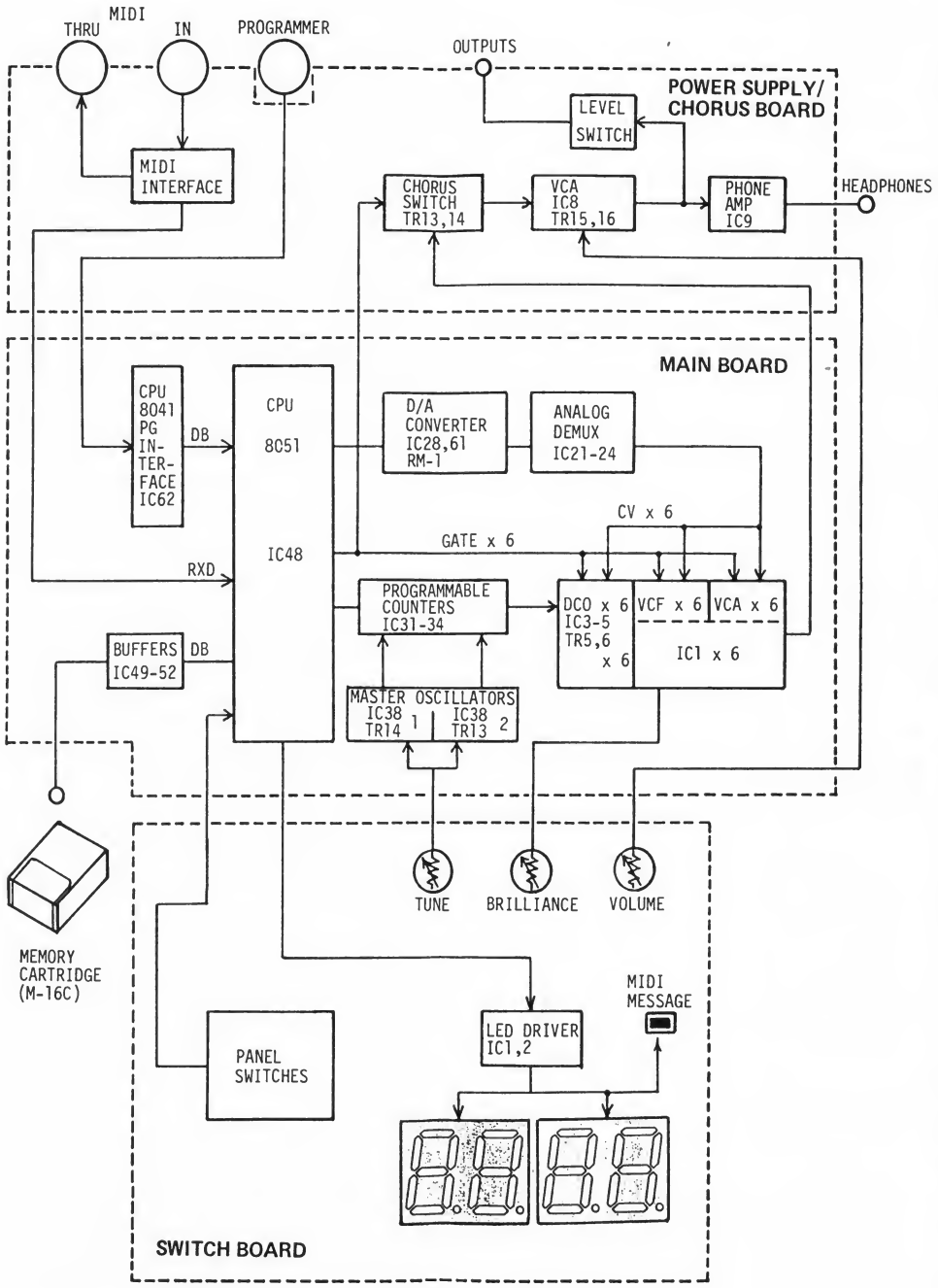
DETACHABLE CORD SET 着脱式コード・セット

13439825	DC-32-J01	100V
13439812F0	VC-704-J01	117V
13439813F0	EC-210-J01	220V
13439814F0	SC-415-J06	240V 3P (Australia)
13438817F0	EC-702-J05	240V 3P (w/2-prong plug for early England version)
or 13439846	BH-301-J01	240V 3P (England, w/3-prong plug)

OTHERS その他

12569111	Lithium Battery CR-1/3N
12369410	Line Cord Strain Relief 1702B
13429523	IC Socket SMO-28-S6T 28P
22125164	Plate Power Transformer
22465472	Heat Sink
22195475	LED Holder
22245448	Cover Slider
22373601	Memory Cartridge M-16C (MKS-30 factory preset)

BLOCK DIAGRAM



CIRCUIT DESCRIPTIONS

The MKS-30 accepts two kinds of external data coming from a MIDI-equipped instrument and the Programmer PG-200 - - - both in the form of a serial digital stream. MIDI information is fed to the Main CPU as it is and its rather distorted waveforms are re-shaped at TR3 and TR4 on the Power Supply/Chorus Board (PS/CH BRD). While the data from the Programmer are first converted to parallel 8 bits at Interface CPU IC62 outputs on the Main Board.

NOTE: The circuit and the PCB of the Main Board are revised versions of the GR-700 Guitar Synthesizer module and the terminal designations remain unchanged. Therefore, some function names on these terminals are not strictly appropriate for this unit. For example, BRILLIANCE control voltage comes to the "VCFPDL" pin.

DATA OUTPUT

Having obtained data - - - concerning a note that is being or will be generated . . . from MIDI input, PG-200 and Panel switch, the master CPU IC48 delivers data in digital format through three routes:

* To Programmable Counters (IC31–IC34) - - - note information
* To D/A converter (IC28, IC61 and RM1) - - - tone parameters and volume control signal
* To SW OUT (IC27) - - - Waveform and function selections

DCO (DIGITAL CONTROLLED OSCLLATOR)

MASTER OSCILLATOR

Master Oscillator TR14 (13) runs at around 4MHz and varies its frequency as the base bias is changed from TUNE (DCO 1 and DCO 2) and FINE TUNE (DCO 2, TR13 only). The variable range is 436 to 448Hz at A above middle C with respect to the center frequency 442Hz.
Other frequency parameters such as LFO, ENV and RANGE will have an effect through software only after being processed by the CPU.

The CPU IC48 can accomodate MIDI note numbers from 0 to 127 while the pitch range of MKS-30 as a whole is from 21 to 108. The CPU will shift odd notes to the nearest octave within the range. The same function will work while RANGE is set in 16' or 4': higher and lower octaves may repeat the same pitch.

RANGE

The Master Oscillator is divided by either 1/2, 1/4 or 1/8 at IC39 (IC37) which in turn receives footage selection (RANGE setting) data from the CPU through IC41. This will give the Programmable Counters the greater frequency resolution capabilities (16 bits plus 2 bits).

LFO, ENV AND DCO 2 TUNE

These parameters do not directly affect the frequency being generated, rather they are combined with a note data which the CPU IC48 has obtained from MIDI INPUT. These combined data are placed on the CPU data bus and routed to the Programmable Counters 8253 ICs 31–34 as divisors.

PROGRAMMABLE COUNTERS

Programmable Counter 8253 containing three 16-bit counters is capable of dividing high frequency signals from the Master Oscillator according to the divisor data from the CPU. Assuming that the master oscillator runs at 4MHz and the divisor is 4000, the counter develops 1kHz rectangular signals. A divisor is a data which the CPU provides based on MIDI data and the edited data from the PG-200 to determine the pitch of a note being played on the MIDI keyboard. Beside note information, divisor data contains the following:

For DCO 1 - - - LFO, ENV
For DCO 2 - - - Above plus DCO 2 Tune
In SYNC mode, pulses from DCO 1 are applied to the gate of mated counter of DCO 2 as reset pulses.

D/A & S/H

Parameters that determine the timbre of audio signal flowing into Synthesizer module are converted into analog equivalent (0 to 4.7V) through D/A converter consisting of IC28, 29, 30, R-2R ladder resistor RM1 and IC61. Buffers (IC29) in MSB 2 bit lines significantly reduce the effects of output impedances of ICs 28 and 30. The D/Aed parameters are then applied commonly to Demultiplexers ICs 21 to 24 and are sampled and held into the correct channel in individual stages - - - total 29 control voltages.

SWITCH OUTPUT AND SELECTION

ON or OFF and selection between circuit functions in the Modules and successive stages are performed at electronic switches named as DCO WAVEFORM, SYNC, SYNMET and NOISE. Switch Control signals from Latch IC27 are fed to switch gears either directly or through IC26. NOISE ON signal is also routed to pin 1 of IC37 to block DCO 2 master frequency.

WAVEFORM CONVERSION

Output from Programmable Counter 8253 is rectangular. So there is a need to convert it to sawtooth when selected. The conversion is carried out on the constant-current integrating-circuit (C8) making use of IC4. The rate of current flowing into C8 is determined by the output from the S/H circuit of DCO CV. Pulse at TR6 base (differentiated IC31 output) discharges C8 at the rectangular rate.

DCO CV contains amounts of ENV, LFO, RANGE, etc. relating to note pitch, and keeps the sawtooth amplitude constant over the frequency range. The CPU will add a bias to DCO CV to exessively increase charging current when the program needs pulse-like sawtooth.
When rectangular is selected, it is allowed to pass NAND gate IC5, while TR6 is kept conducting by forward bias from pins 1 and 15 of IC26, bypassing C8 charging current.

NOTE: When sawtooth wave is selected, pin 4 of IC5 stays high (+5V).

SYNC

With positive voltages at pins 2 and 12, IC5 develops and applies reset pulses to DCO 2 Programmable Counter and to TR5 base at a DCO 1 rate.

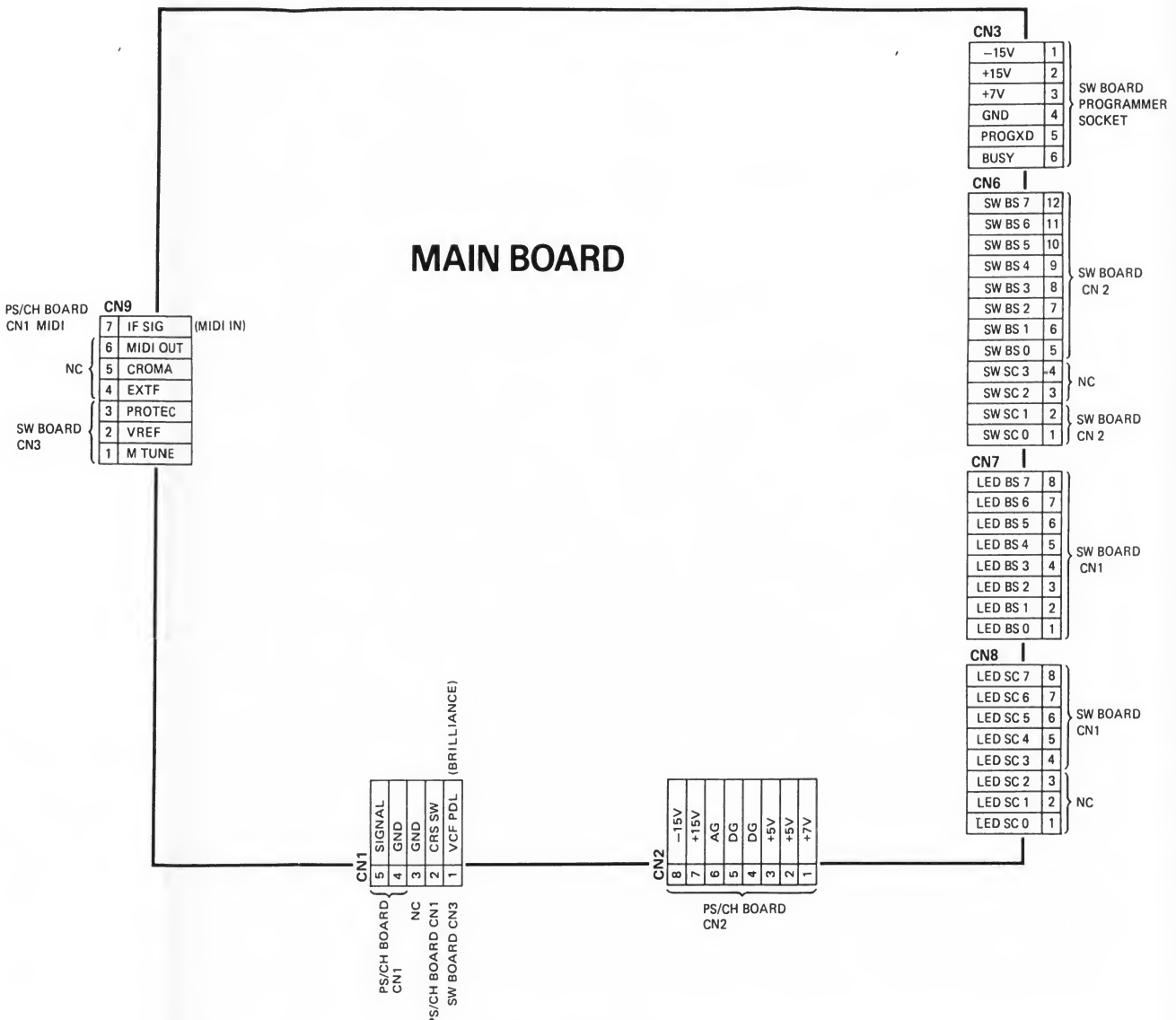
VCF AND VCA

IC1 is a hybrid IC containing both VCF and VCA. Beside CPU controlled voltage, VCF CUTOFF can be controlled by a manual override (BRILLIANCE control) from front panel slider. Since the chip has many parameter inputs, it requires these inputs to be tailored for the optimum parameter setting. CUTOFF, RESONANCE, VCA LEVEL and DC BALANCE should be readjusted whenever the chip is renewed.

CHORUS

Output from VCA is fed to MIX/HPF (IC60 and IC6a) then to CHORUS circuit on the Power Supply/Chorus Board.
The Chorus circuit consists of two identical BBD stages having low frequency modulation input from triangular oscillator and buffer IC4 and IC5. Two triangulars are out of phase with each other.

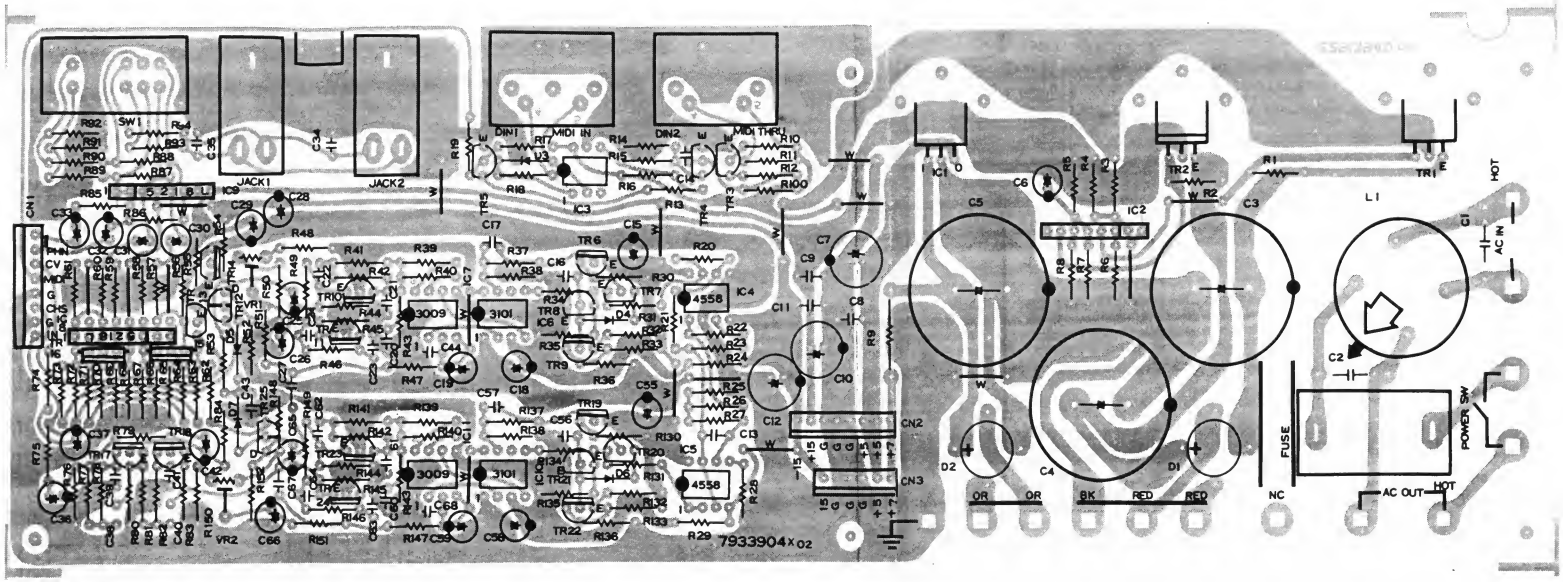
INTERCONNECTION



POWER SUPPLY / CHORUS BOARD

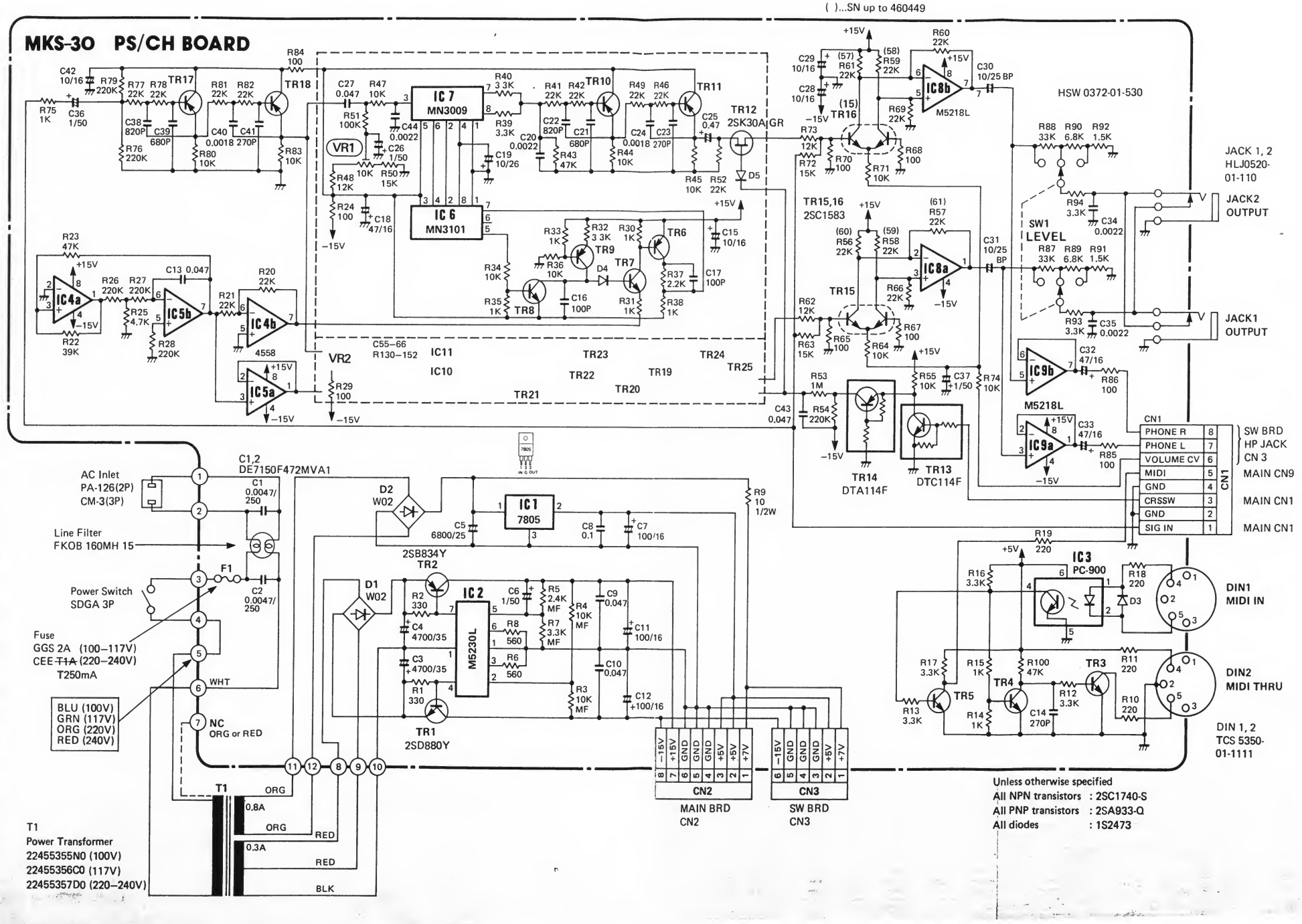
79339042 100/117V
(pcb 22913940)

79339044 220/240V
(pcb 22913940)



( )...SN up to 460449

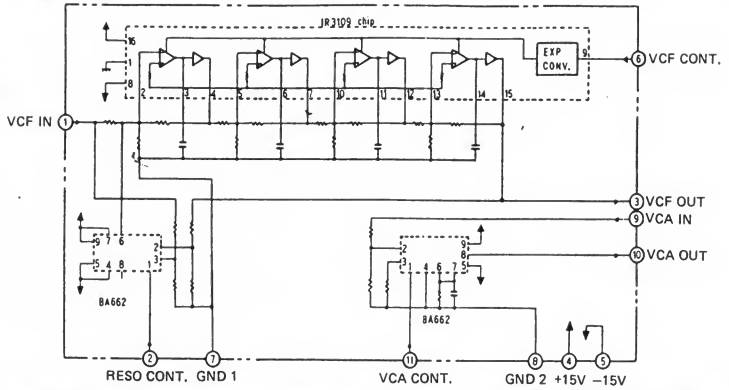
MKS-30 PS/CH BOARD

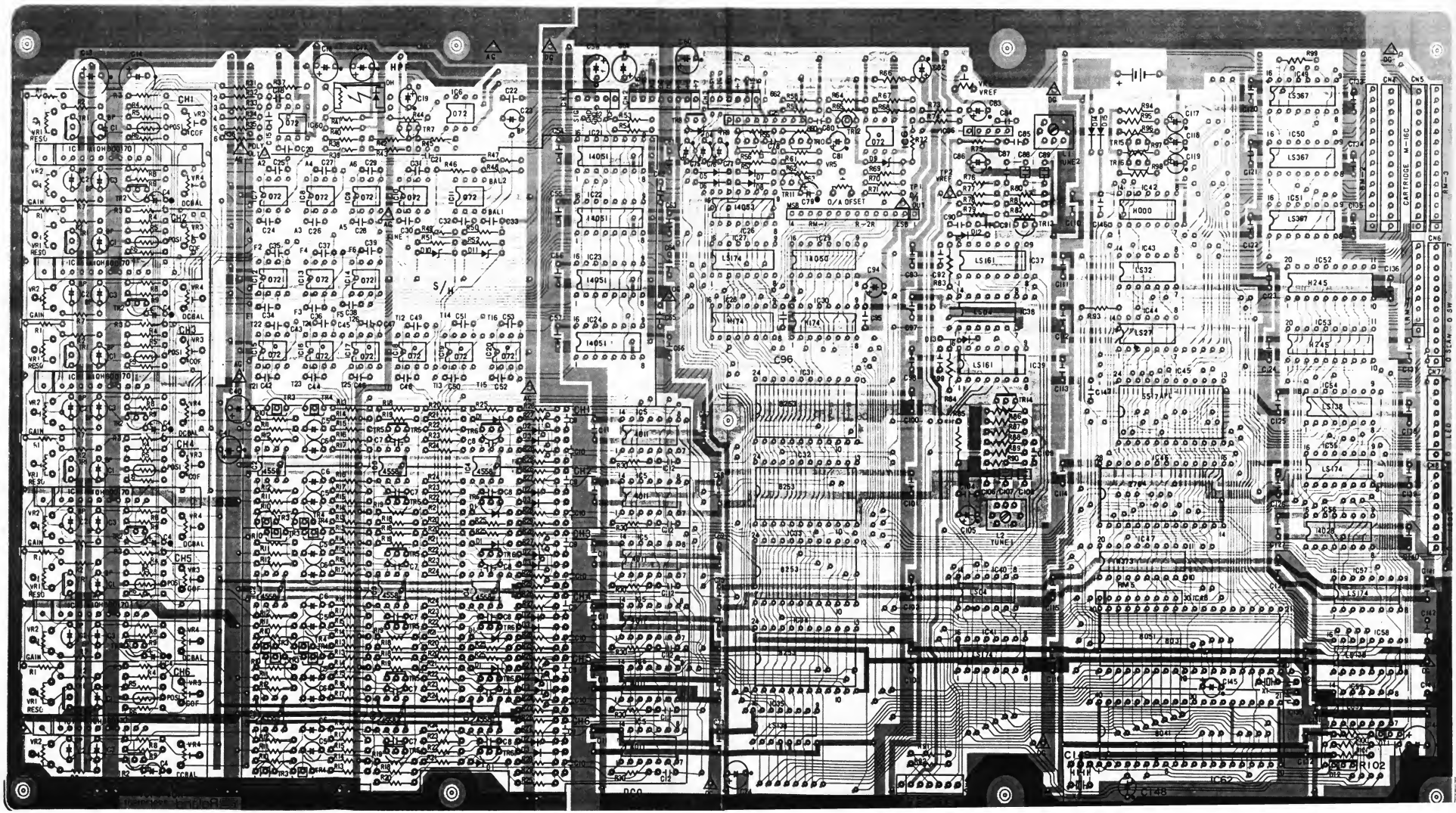


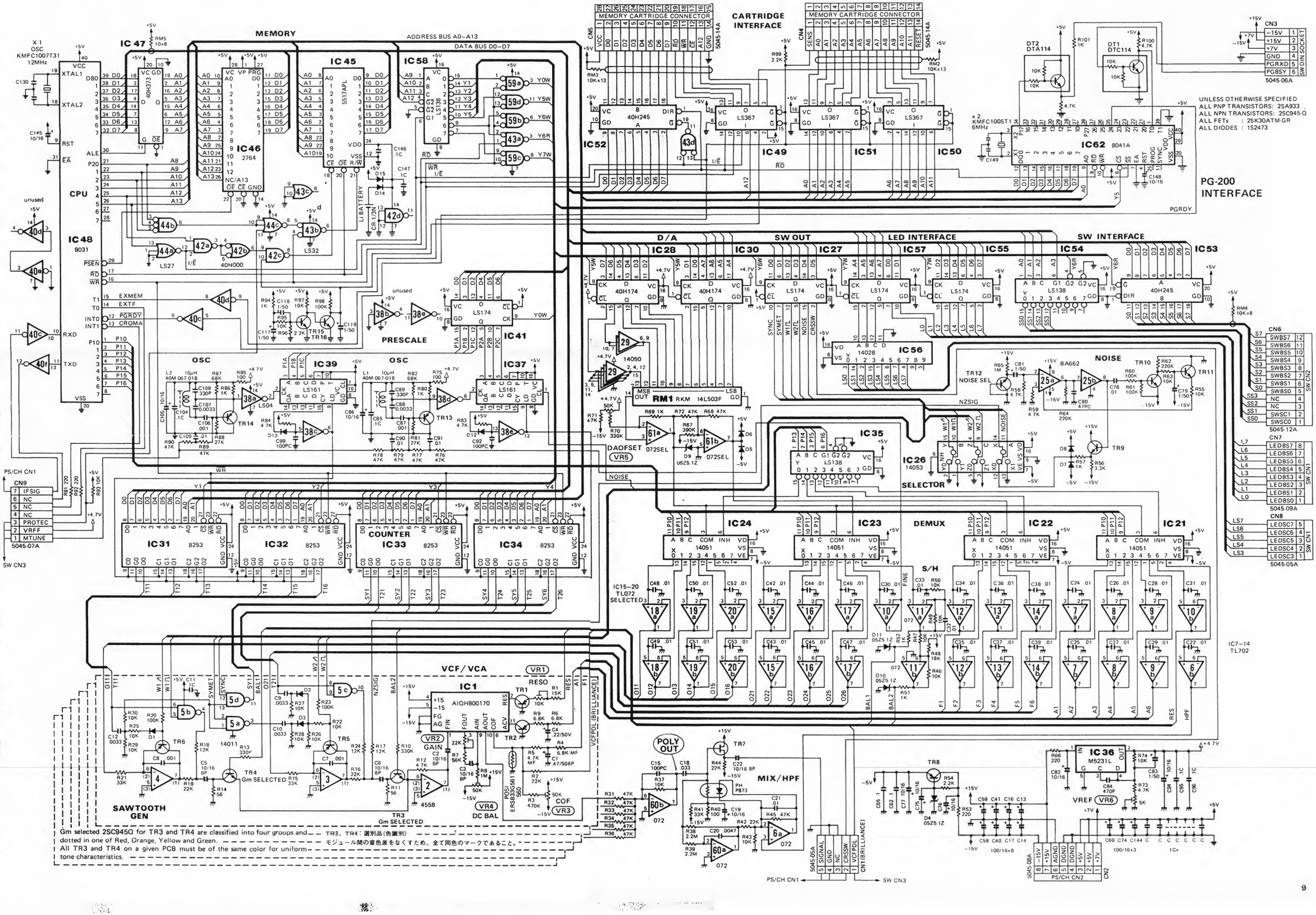
MAIN BOARD

79339060
(pcb 2291391601)

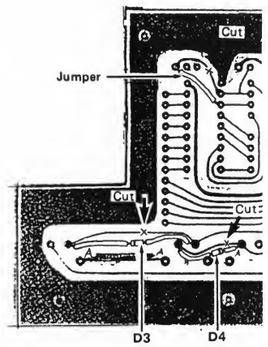
IC1 A1QH800170
VCF/VCA
BLOCK DIAGRAM



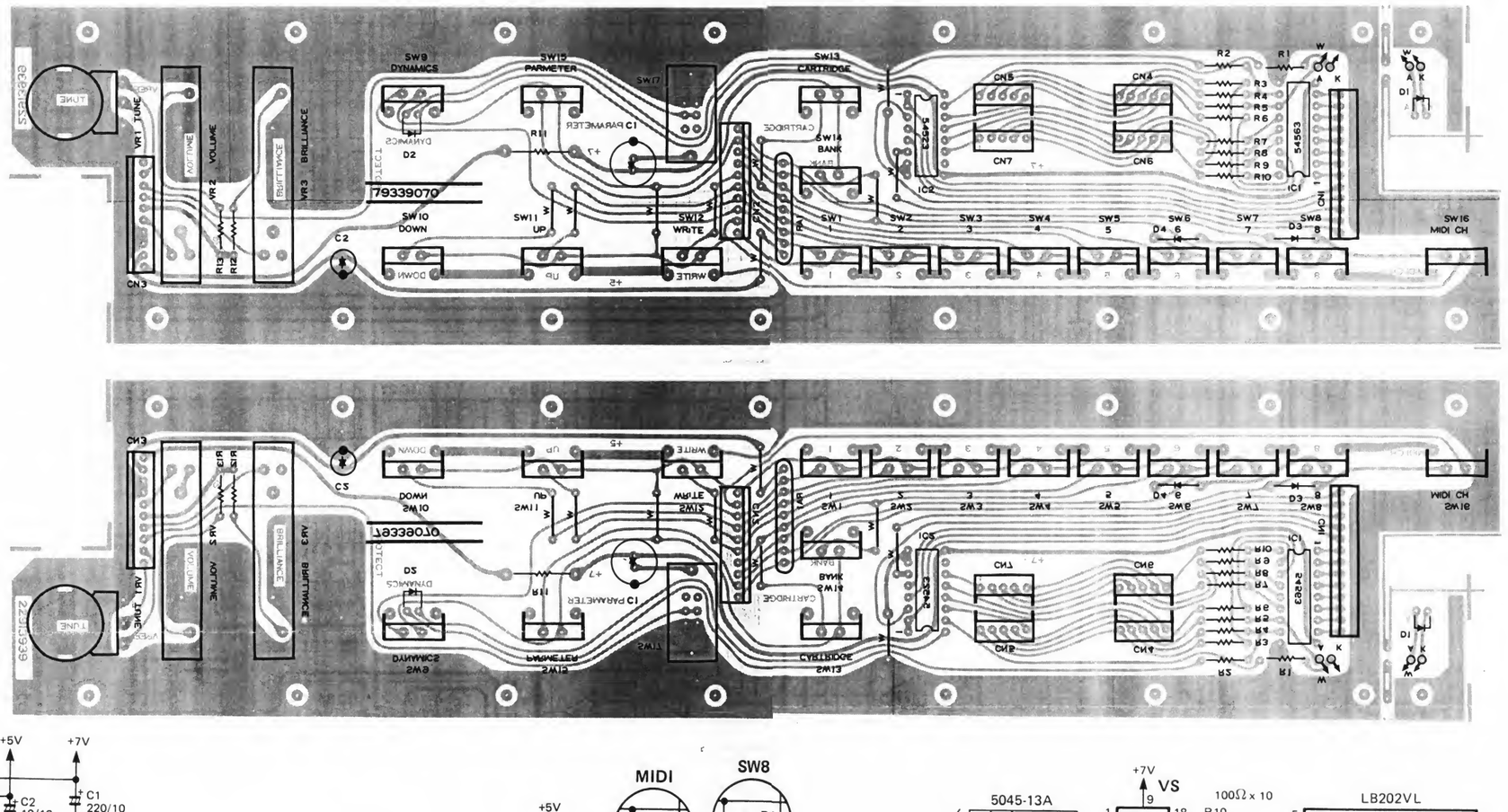



MEMORY
ADDRESS BUS A0–A13
DATA BUS D0–D7
CARTRIDGE INTERFACE
MEMORY CARTRIDGE CONNECTOR
PG-200 INTERFACE
UNLESS OTHERWISE SPECIFIED
ALL PNP TRANSISTORS: 2SA933
ALL NPN TRANSISTORS: 2SC945-Q
ALL FETs : 2SK30ATM-GR
ALL DIODES : 1S2473
CPU
PRESCALE
OSC
COUNTER
D/A
SW OUT
LED INTERFACE
SW INTERFACE
NOISE
SELECTOR
DEMUX
S/H
VCF/VCA
SAWTOOTH GEN
MIX/HPF
POLY OUT
DAOFSET
VREF
IC1 AIQH800170
IC36 M5231L
IC7–14 TL702
IC15–20 TL072 SELECTED
Gm selected 2SC945Q for TR3 and TR4 are classified into four groups and dotted in one of Red, Orange, Yellow and Green.
All TR3 and TR4 on a given PCB must be of the same color for uniform tone characteristics.
TR3、TR4：選別品(色識別)
モジュール間の音色差をなくすため、全て同色のマークであること。

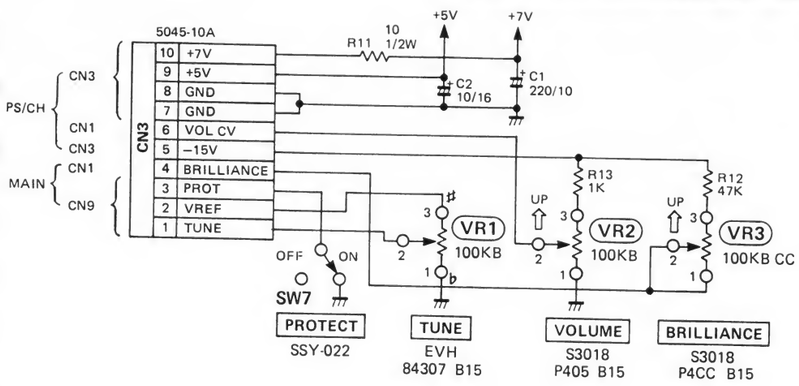
SWITCH BOARD
79339070
(pcb 22913939)

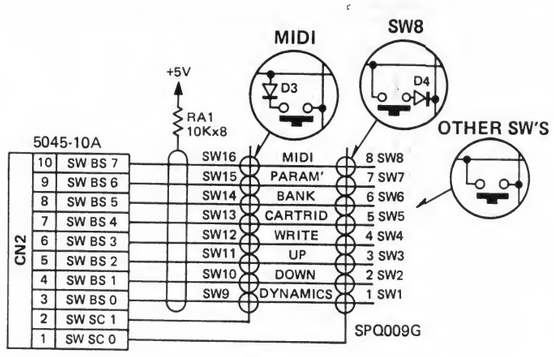


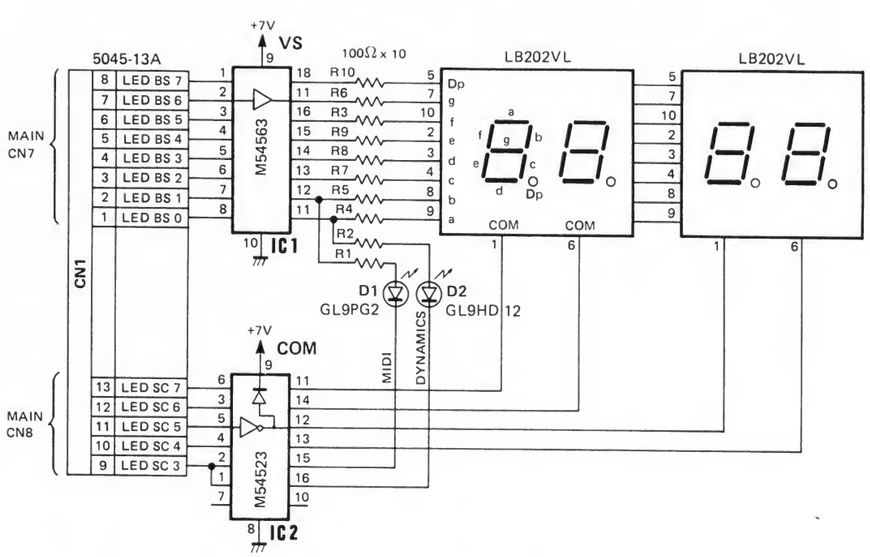
SN up to 450449

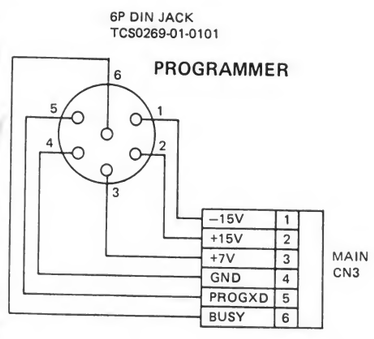


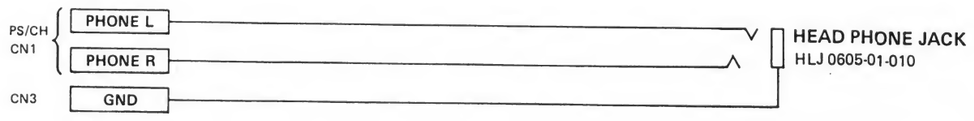
View from foil side











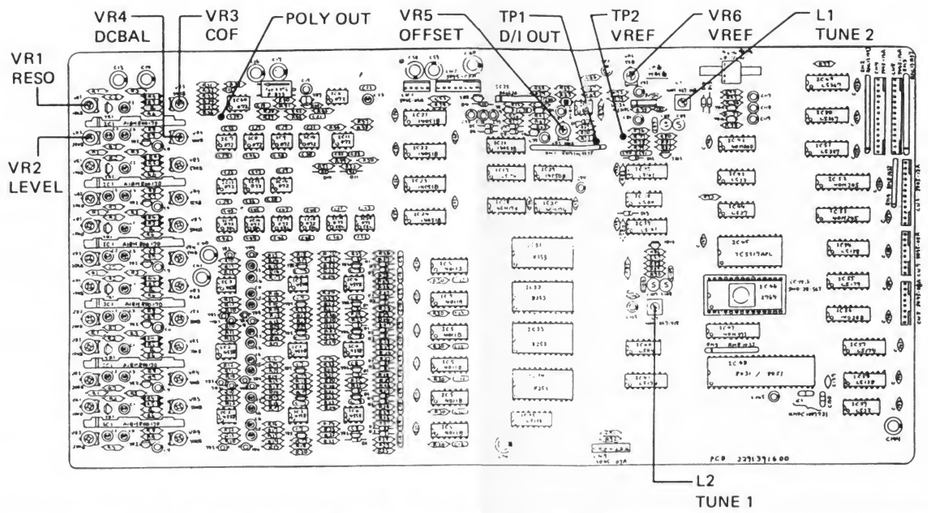
ADJUSTMENT

DC supply voltage must be checked and adjusted as necessary before attempting any other adjustments.

REFERENCE VOLTAGE

1. Connect digital voltmeter to TP-2 (VREF) of Main board.
2. Adjust VR6 for 4.70V reading.

MAIN BOARD



TEST PROGRAM

The MKS-30 is provided with Test program which can be fetched only when in the test mode.

ENTERING TEST MODE

BANK PATCH

1. Switch power ON.

MIDI CHANNEL NUMBER

BANK, PATCH NUMBER

NORMAL MODE

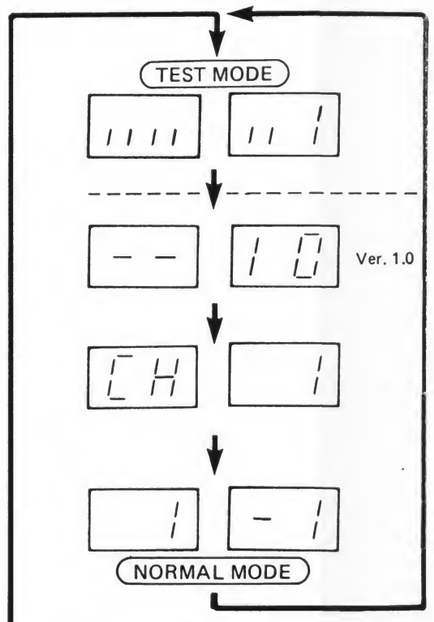
2. While pressing MIDI CHANNEL, press DYNAMICS.

YEAR

The date of program implementation.

MONTH DAY

(June 1, 1984)



NOTE:
When step 2 above is repeated, display will indicate the program version. Then the unit returns to the normal operation mode. Another repetition of step 2 will put the unit again to the test mode.

During the test mode the display will indicate a currently used test signal and the module being assigned to a note.

TEST KEYBOARD

The number buttons No. 1 to No. 8 can be used as a temporary keyboard during the test mode.
Holding down MIDI CHANNEL, press a number button: No. 1 represents C and No. 8 C an octave up; the remaining numbers serve as natural keys D to B respectively.

KEY ASSIGNMENT

The test program contains three key assignments. Selection among key assign modes is accomplished by pressing Number button No. 1, 2 or 3 while holding down WRITE button.

[1] SemiRotary

Default setting or when No. 1 button is pressed while WRITE button is being held down.
Repeating the same Number retriggers the same module; a second Number button is assigned any of the remaining modules, a third another and so on.

[2] Rotary

Pressing No. 2 button while holding down WRITE button enters this mode. Pressing a number button (same or different) will advance module number to another.

[3] NonRotary

Pressing No. 3 button while holding down WRITE button enters this mode. Pressing a single Number button (same or different) will stay on the same module.
To shift the module to be assigned, press PARAMETER UP button: once for the next module, twice for the third module, etc. Pressing UP six times returns to the original.

SETTING AND TEST INSTRUMENTS

TUNE: center
Oscilloscope
Amp (or Headphones)
BRILLIANCE: center
Frequency Counter

HOLD

Releasing MIDI CHANNEL before a Number button will hold the note.

CANCELING HOLD

While holding MIDI CHANNEL tap the Number button. If fail, try another Number(s).

CAUTION If DYNAMICS is lit during a step, press it again to turn off.

1. TUNING

DCO 1

TUNE - - - center
Test Point - - - POLY OUT or OUTPUT/Headphones

KEY ASSIGNMENT: [1] SemiRotary
TEST SIGNAL: 1 - - - Press No. 1 button (DCO 1 sawtooth wave selected).

1-1. While pressing MIDI CHANNEL, press No. 6 button, then release MIDI CHANNEL - - - Note A will be sustained (Hold ON condition).
1-2. Adjust L2 for 442Hz.

DCO 2

TEST SIGNAL: 2 - - - Press No. 2 button (DCO 1 and 2 sawtooth waves selected.

1-3. Adjust L1 for zero beat between DCO 1 and 2.

2. D/A OFFSET

Test Point - - - POLY OUT

KEY ASSIGNMENT: [1] SemiRotary
TEST SIGNAL: 1 - - - Press No. 1 button (DCO 1 sawtooth wave selected).

2-1. While holding MIDI CHANNEL, press Number buttons 1 to 6 one by one and note a module that producing the lowest output (not a misprint, smallest one).
2-2. Holding the lowest output, adjust VR5 for the onset of clipping.

3. VCA LEVEL

Test Point - - - POLY OUT

KEY ASSIGNENT: [2] Rotary - - - Hold WRITE and press No. 2 button.
TEST SIGNAL: 3 - - - Press No. 3 button (square wave selected).

3-1. While holding MIDI CHANNEL , press No. 1 button, then release MIDI CHANNEL - - - Hold ON.
3-2. Adjust VR2 of the module being assigned (check on the display) for 600mVp-p.
3-3. First hold down MIDI CHANNEL then tap several number buttons until currently assinged module disappears on the display. While pressing MIDI CHANNEL, press a Number button. The module will shift; confirm the module number on the display. Adjust the VR2 of the new module for 600mVp-p.
3-4. In the same manner adjust the remaining modules.

4. VCA DC BALANCE

Test Point - - - POLY OUT or Headphones

KEY ASSIGNMENT: [1] SemiRotary - - - While holding WRITE, press No. 1 button.
TEST SIGNAL: 4 - - - Press No. 4 button (GATE signal selected).

4-1. While holding MIDI CHANNEL, tap a number button repeatedly and adjust VR4 of the module being selected for the minimum thump.
4-2. In the same way adjust the remaining modules. But by tapping a different key for each module and by turning the correct VR4.

5. VCF

A. RESONANCE

Test Point - - - POLY OUT BRILLIANCE - - - center

CAUTION Turn DYNAMICS OFF, if lit.

KEY ASSIGNMENT: [1] SemiRotary - - - WRITE plus No. 1 buttons.
TEST SIGNAL: 5 - - - Press No. 5 button (Key-independent pitch provided).

5-1. Press a number button (Hold ON). Turn VR1 of the module being assigned fully clockwise; VCF will oscillate. Adjust the VR1 for 250mVp-p.

B. CUTOFF

5-2. Adjust VR3 of the module being assigned for 1kHz.
5-3. VR3 affects step 5-1. Repeat 5-1 and 5-2 until no further improvement is obtained.
5-4. In the simmilar way adjust the remaining modules (the first-adjusted wave may be used as a reference in zero beat sound method - - - Hold ON facility being used).

6. VCF PITCH FOLLOW

CAUTION This adjustment must be done after completion of para. 5.

KEY ASSIGNMENT: [1] SemiRotary or [2] Rotary
TEST SIGNAL: 6 - - - Press No. 6 button (VCF regeneration and KCV selected.

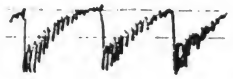
6-1. Play the number buttons and confirm the scale.

7. RESONANCE

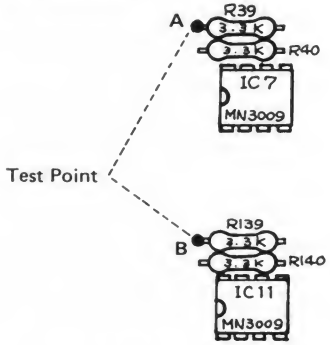
Test Point - - - POLY OUT

KEY ASSIGNMENT: [1] SemiRotary or [2] Rotary
TEST SIGNAL: 7 - - - Press No. 7 button (Resonating sawtooth wave selected).

7-1. While holding MIDI CHANNEL button, hit the Number buttons and check for resonant waves.



8. BBD BIAS



POWER SUPPLY/CHORUS BOARD

KEY ASSIGNMENT: [1] SemiRotary or [2] Rotary
TEST SIGNAL: 1 - - - Press No. 1 button (sawtooth wave selected).

8-1. Connect the scope to point A.
8-2. While Holding 8 notes ON (Hold ON) adjust VR1 for centered waveforms.
8-3. Connect the scope to point B.
8-4. Adjust VR2 for centered waveform

MIDI IMPLEMENTATION

RECOGNIZED RECEIVE DATA

Status	Second	Third	Description	
1000 nnnn	0kkk kkkk	0vvv vvvv	Note OFF kkkkkkk = 0 - 127 (21 - 108) velocity ignored	
1001 nnnn	0kkk kkkk	0000 0000	Note OFF kkkkkkk = 0 - 127 (21 - 108)	*2
1001 nnnn	0kkk kkkk	0vvv vvvv	Note ON kkkkkkk = 0 - 127 (21 - 108) vvvvvvv = 1 - 127	*2
1011 nnnn	0000 0001	0vvv vvvv	Modulation	*3
1011 nnnn	0100 0000	0111 1111	hold on (1 - 126 ignored)	*3
1011 nnnn	0100 0000	0000 0000	hold off	
1100 nnnn	0ppp pppp		Program Change ppppppp = 0 - 127	*3 *5
1110 nnnn	0bb0 0000	0bbb bbbb	Pitch Bender	*3,4
1011 nnnn	0111 1011	0000 0000	ALL NOTES OFF	
1011 nnnn	0111 1100	0000 0000	OMNI OFF (ALL NOTES OFF)	*1
1011 nnnn	0111 1101	0000 0000	OMNI ON (ALL NOTES OFF)	*1
1011 nnnn	0111 1110	0vvv vvvv	ALL NOTES OFF	*1
1011 nnnn	0111 1111	0000 0000	POLY ON (ALL NOTES OFF)	*1

Notes:

* nnnn = 0 - 15 corresponds to channel 1 - 16.

*1 Mode messages (123 - 127) are also recognized as ALL NOTES OFF.

Mode messages are recognized as follows:

	POLY ON (127)	MONO ON (126)
OMNI OFF (124)	OMNI = OFF POLY	OMNI = OFF POLY
OMNI ON (125)	OMNI = ON POLY	OMNI = ON POLY

* Mode messages (123 thru 127) are recognized in only the basic channel. While in OMNI ON mode, voice messages in all channels are recognized. While in OMNI OFF mode, voice messages in only the basic channel are recognized.

* When power is first applied, the default mode is MODE 3 (OMNI OFF,POLY).

* The basic channel can be changed by panel operation. The current basic chaneel number will be retained even after power is turned OFF.

*2 Note numbers outside the range (21-108) are shifted to the nearest octave within the range.

*3 These are enabled or disabled to be recognized by panel operations. These conditions are memorized when power is OFF.

Panel operations:

Pressing the following switches (number buttons) while holding down MIDI CHANNEL toggles the respective functions.

Switch	Function
3	program change
4	hold pedal
5	pitch bender
6	modulation

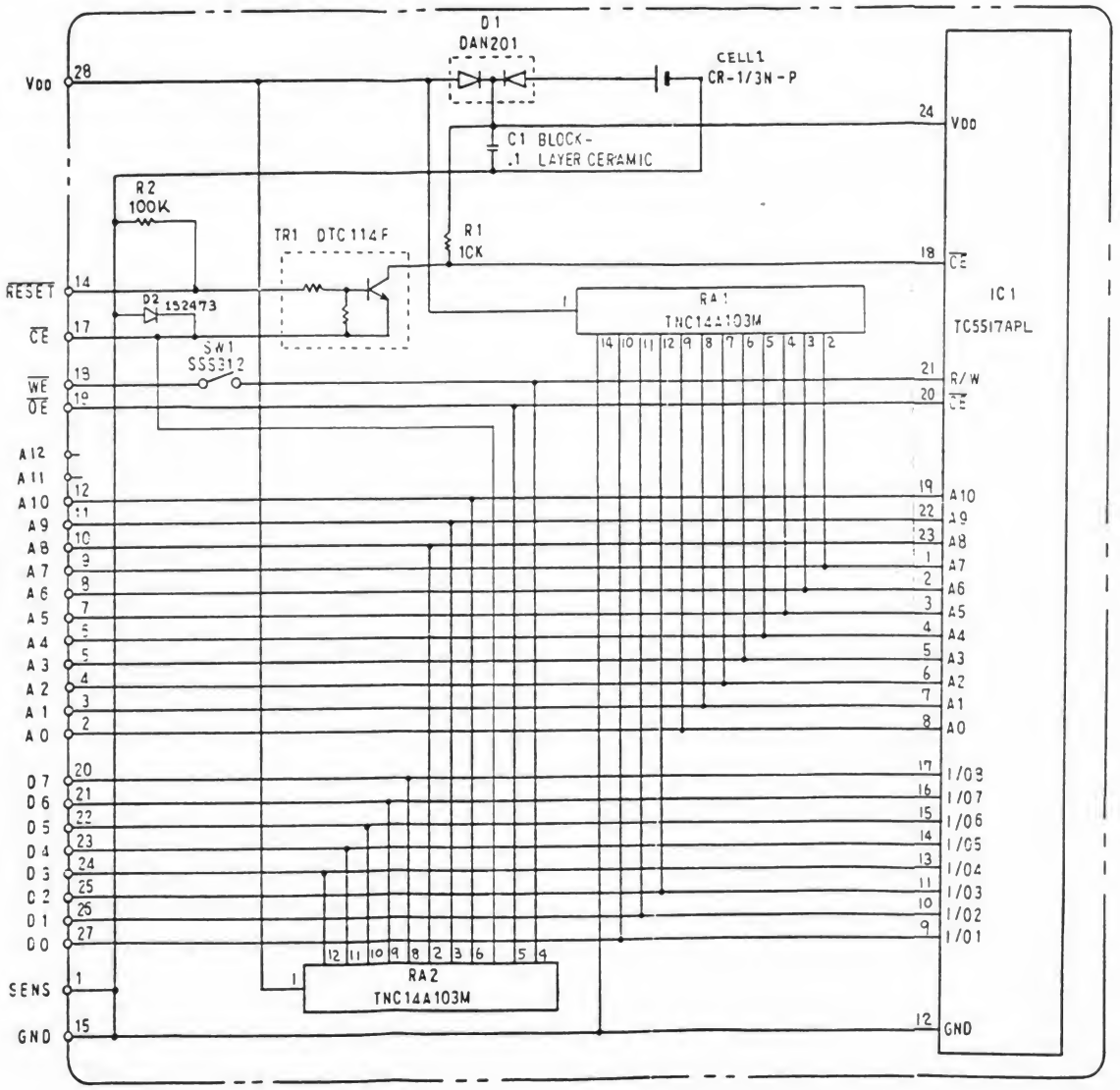
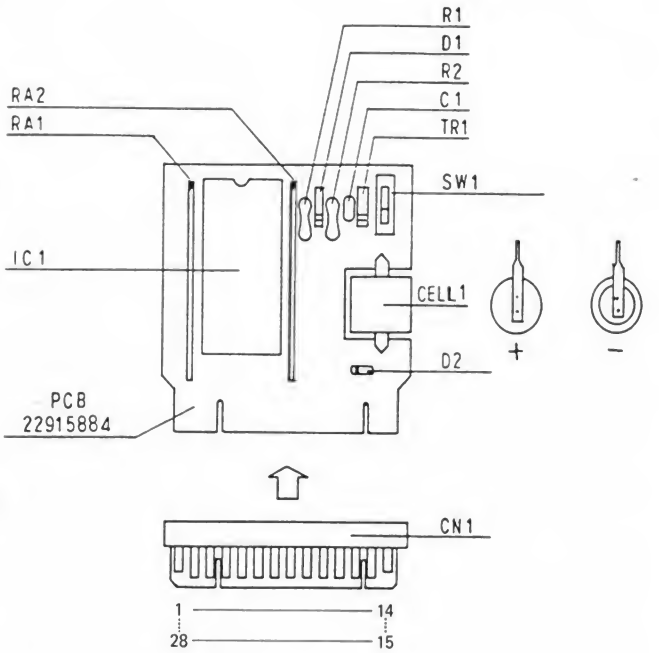
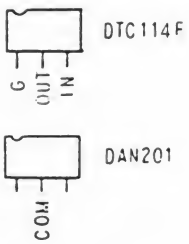
*4 Sensitivity of the PITCH BENDER can be adjusted within the range of 0 to 7 semitones.

Message	Max. value	Min. value	
MSB	127	0	
LSB	96	0	
Sensitivity			
MAX	+7	-7	semitones
MIN	+1	-1	
ZERO	0	0	

*5 Program change assignments are as follows: B:bank P:patch

Prog #	B	P	Prog #	B	P	Prog #	B	P	Prog #	B	P
0	1	1	16	3	1	32	5	1	48	7	1
1	1	2	17	3	2	33	5	2	49	7	2
2	1	3	18	3	3	34	5	3	50	7	3
3	1	4	19	3	4	35	5	4	51	7	4
4	1	5	20	3	5	36	5	5	52	7	5
5	1	6	21	3	6	37	5	6	53	7	6
6	1	7	22	3	7	38	5	7	54	7	7
7	1	8	23	3	8	39	5	8	55	7	8
8	2	1	24	4	1	40	6	1	56	8	1
9	2	2	25	4	2	41	6	2	57	8	2
10	2	3	26	4	3	42	6	3	58	8	3
11	2	3	27	4	4	43	6	4	59	8	4
12	2	5	28	4	5	44	6	5	60	8	5
13	2	6	29	4	6	45	6	6	61	8	6
14	2	7	30	4	7	46	6	7	62	8	7
15	2	8	31	4	8	47	6	8	63	8	8

Prog #	B	P	Prog #	B	P	Prog #	B	P	Prog #	B	P
64	1	1	80	3	1	96	5	1	112	7	1
65	1	2	81	3	2	97	5	2	113	7	2
66	1	3	82	3	3	98	5	3	114	7	3
67	1	4	83	3	4	99	5	4	115	7	4
68	1	5	84	3	5	100	5	5	116	7	5
69	1	6	85	3	6	101	5	6	117	7	6
70	1	7	86	3	7	102	5	7	118	7	7
71	1	8	87	3	8	103	5	8	119	7	8
72	2	1	88	4	1	104	6	1	120	8	1
73	2	2	89	4	2	105	6	2	121	8	2
74	2	3	90	4	3	106	6	3	122	8	3
75	2	4	91	4	4	107	6	4	123	8	4
76	2	5	92	4	5	108	6	5	124	8	5
77	2	6	93	4	6	109	6	6	125	8	6
78	2	7	94	4	7	110	6	7	126	8	7
79	2	8	95	4	8	111	6	8	127	8	8

The program change numbers 0 chru 63 are assigned to internal memory. The numbers 64 thru 127 are assigned to the memory cartridge if it is equipped. If not, they are assigned to internal.

MEMORY CARTRIDGE M-16C